



Seasonal forecasting of global hydrologic extremes using the North American Multi-model Ensemble system

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Seasonal hydrologic extremes in the form of droughts and wet spells have devastating impacts on human and natural systems. Improving our understanding and predictive capability of hydrologic extremes, and facilitating adaptations through establishing climate service systems at regional to global scales, are among the grand challenges proposed by the World Climate Research Programme (WCRP), and are the core themes of the Regional Hydroclimate Projects (RHP) under the Global Energy and Water Exchanges Project (GEWEX). An experimental global seasonal hydrologic forecasting system has been developed, which is based on coupled climate forecast models participating in the North American Multi-Model Ensemble (NMME) project and an advanced land surface hydrologic model. The system is evaluated over major GEWEX/RHP river basins by comparing with Ensemble Streamflow Prediction (ESP). The multi-model seasonal forecast system provides higher detectability for soil moisture droughts, more reliable low and high flow ensemble forecasts, and better “real-time” prediction for the 2012 North American extreme drought. The association of the onset of extreme hydrologic events with oceanic and land precursors is also investigated based on the joint distribution of forecasts and observations. Climate models have a higher probability of missing the onset of hydrologic extremes when there is no oceanic precursor. But oceanic precursor alone is insufficient to guarantee a correct forecast, a land precursor is also critical in avoiding a false alarm for forecasting extremes. This study is targeted at providing the scientific underpinning for the predictability of hydrologic extremes over GEWEX/RHP basins, and serves as a prototype for seasonal hydrologic forecasts within the Global Framework for Climate Services (GFCS).